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APPLICATION

FOR

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TITLE: CONTROLLING THE POSITION OF AN OBJECT IN THREE DIMENSIONS

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CONTROLLING THE POSITION OF AN OBJECT IN THREE DIMENSIONS

Background

This invention relates generally to devices that are able to position other devices without contacting those devices.

In a number of toy applications, it is desirable to move a game piece or toy element in two or more dimensions. For example, in a number of play scenarios involving board games, a play piece may be moved by the user. In addition, play pieces may be manipulated by the user in various toy scenarios.

Generally, toy manipulation techniques require the child to actually grab the toy and to position the toy where desired. This limits the realism that is possible and thereby reduces the value of the toy.

Children have been fascinated by magicians who use so-called levitation techniques to cause objects to rise into the air, apparently without physical contact. Usually, these techniques involve using thin wires that are not visible to the user.

Nonetheless, levitation acts create a sense of wonderment and are entertaining for children of a variety of ages. Therefore, there would be a considerable interest in a toy which actually implements a levitation trick.

In particular, a toy that enables the levitation of play pieces would be of considerable potential play value.

Brief Description of the Drawings

Figure 1 is a perspective view of one embodiment of the present invention;

Figure 2 is a cross-sectional view taken generally along the line 2-2 in Figure 1;

Figure 3 is a block depiction of the embodiment shown in Figure 2;

Figure 4 is a depiction of a walls 12 in accordance with one embodiment of the present invention;

Figure 5 is a flow chart for software in accordance with one embodiment of the present invention; and

Figure 6 is a flow chart for software in accordance with another embodiment of the invention.

Detailed Description

Referring to Figure 1, a three dimensional, partial enclosure or three dimensional structure 10 may facilitate the contact-free manipulation of the position of a toy play piece 11. In the illustrated embodiment, the play piece 11 is a toy submarine submerged in a liquid L contained by the structure 10. In one embodiment, the enclosure 10 includes a plurality of peripheral walls 12 and a bottom surface 15. The top surface of the structure 10 may be open for access and viewing in one embodiment.

As shown in Figure 2, the play piece 11 may include a permanent magnet 13. As will be described in more detail, the play piece 11 may be eletromagnetically positionable due to the influence of electromagnets in the walls 12 on the permanent magnet 13. In addition, in some embodiments, the play piece 11 may include one or more air pockets to make the play piece 11 neutrally buoyant.

While the play piece 11 is illustrated as being neutrally buoyant in a liquid L, in other embodiments, the play piece 11 may be suspended in air. For example, the play piece 11 may include buoyancy enhancing material such as helium. Alternatives, the play piece 11 may be sufficiently light to be suspended by the electromagnetic fields described hereinafter. As still another embodiment, the play piece 11 may be uplifted by upwardly directed air flows.

Referring to Figure 4, each wall 12, such as the wall 12d, includes a plurality of electromagnets 22. Each electromagnet 22 is capable of generating an electromagnetic field that attracts or repels the permanent magnet 13 in the play piece 11.

In some embodiments, the electromagnets 22 may be molded directly into the wall 12. In still another embodiment, the electromagnets 22 may be incorporated into a film which is attached on the inside surface of the wall

12. A variety of other techniques may be utilized to associate the electromagnets 22 with the walls 12.

A matrix of electromagnets 22 in each wall 12a to 12d may allow relatively fine control over the attractive or repulsive forces applied electromagnetically to the play piece 11. That is, current may be selectively applied to one or more of the electromagnets 22 to create the desired force that enables positioning of the toy play piece 11 relative to any set of electromagnets 22. Moreover, if electromagnets 22 are provided in each of the surface 15 and walls 12, the play piece 11 may be positioned relative to any of those surfaces as desired, in one embodiment of the present invention.

Referring to Figure 3, in accordance with one embodiment of the present invention, arrays 18 of electromagnets 22 may be provided in each of the walls 12a, 12b, 12c, 12d and even in the bottom surface 15 in one embodiment. Each of the arrays 18 may be controlled by a controller 24. The controller 24 may receive user inputs from an input device 16 and may display information on a display 52. The controller 24 may be associated with a memory 30 that stores information including the software programs 32 and 42.

In accordance with one embodiment of the present invention, the software program 32 may enable the play piece 11 to be precisely positioned in response to user

input commands received through the input device 16. In another embodiment of the present invention, the precise position of a play piece 11 may be determined by the software 42. The software 42 may enable the position of the device to be displayed on a display 52 in one embodiment.

In particular, the controller 24 selectively couples current to any one or more of the electromagnets 22 to develop a sufficient attractive or repulsive force to control the position of the play piece 11. This control may be implemented automatically by software running on the controller 24 which determines, based on the user input, how to appropriately supply current to the electromagnets 22 to achieve the desired play piece 11 positioning.

Referring to Figure 5, the software 32, in accordance with one embodiment of the present invention, may receive an input command from the input device 16, as indicated in block 34. In one embodiment of the present invention, the input device 16 may be a touch screen display that enables the user to simply touch a displayed image of the enclosure 10 to appropriately suggest a play piece 11 position. However, any input device may be used as the input device 16.

The software 32 then calculates the displacement needed to achieve the requested position, as indicated in block 36. Next the software 32 determines the appropriate

electromagnet signals in order to appropriately displace the play piece 11, as indicated in block 38. Finally, the inductor signals may be issued, causing the play piece 11 to move appropriately, as indicated in block 40.

In response to a user request or otherwise, the position of the play piece 11 may be determined by the software 42 in accordance with one embodiment of the present invention. When the play piece 11 is appropriately positioned where desired, the controller 24 may go into a receive mode wherein it receives induced current signals from the arrays 18, as indicated in block 44. Those induced current signals may be indicative of the relative position of the play piece 11 and particularly its permanent magnet 13 relative to various electromagnets 22. Those current signals may then be analyzed as indicated in block 46.

Based on the analysis of those induced current signals, a plurality of signals may be derived as indicated in block 48. Using known characteristics of inductors, those induced current signals may be translated into a corresponding play piece 11 location in three dimensions as indicated in block 48. Thereafter, the calculated play piece 11 location may be displayed on the display 52 as indicated at block 50.

By varying the flow of electricity through any given electromagnet 22, the strength of the field induced by the

electromagnet's inductor may be altered. As a result, the attractive or repulsive applied force and, thus the position of the play piece 11 in three dimensions may be controlled.

In one embodiment of the present invention, an aquarium may be implemented as the enclosure 10. Other play scenarios may include a movie set or game pieces.

While the present invention has been described with respect to a limited number of embodiments, those skilled in the art will appreciate numerous modifications and variations therefrom. It is intended that the appended claims cover all such modifications and variations as fall within the true spirit and scope of this present invention.

What is claimed is: